WHAT IS CLAIMED IS:

1. A bi-directional dc/dc power converter, comprising:

a first dc voltage terminal set consisting of a positive terminal and a negative terminal;

a second dc voltage terminal set consisting of a positive terminal, a negative terminal and a neutral terminal;

an inductor acted as an energy buffer;

a first power electronic device connected in series with an inductor, the combination of the first power electronic device and the inductor is connected between the positive terminal and the negative terminal of the first dc voltage terminal set, turning on/off the first power electronic device is used to perform the step-up power conversion;

a second power electronic device connected between a connected point of the first power electronic device and the inductor, and the positive terminal of the second dc voltage terminal set, turning on/off the second power electronic device is used to perform the step-down power conversion;

a first diode connected parallel with the first power electronic device;

a second diode connected parallel with the second power electronic device;

a capacitor connected between the two positive terminals of the first dc

voltage terminal set and the second dc voltage terminal set; and

a controller connected to two power electronic devices to turn on/off;

wherein the bi-directional dc/dc power converter can carry out the bi-directional power flow; when a power flow direction is from the first dc voltage terminal set to the second dc voltage terminal set, the output voltage of the bi-directional dc/dc power converter is double of the voltage at the first dc voltage terminal set; and alternatively, when the power flow direction is in reverse from the second dc voltage terminal set to the first dc voltage terminal set, the output voltage of the bi-directional dc/dc power converter is half of a voltage at the second dc voltage terminal set.

2. The bi-directional dc/dc power converter as defined in Claim 1, wherein when the power flow direction is from the first dc voltage terminal set to the second dc voltage terminal set, the first power electronic device is controlled to turn on/off and the second power electronic device is not actuated to successively turn off; the inductor is energized by an input dc voltage source from the first dc voltage terminal set and then releases the energy to the capacitor via the second diode; thus, the capacitor provided with a converted output dc voltage is equal to the input dc voltage; since the voltage between the positive and negative terminals of the second dc voltage terminal set is equal to the input dc voltage plus the converted output dc

voltage, the output voltage of the bi-directional dc/dc power converter is double of the input dc voltage; since the input dc voltage is equal to the voltage of the capacitor, the neutral terminal of the second dc voltage terminal set is regarded as a neutral terminal.

3. The bi-directional dc/dc power converter as defined in Claim 1, wherein when the power flow direction is in reverse from the second dc voltage terminal set to the first dc voltage terminal set, the second power electronic device is controlled to turn on/off, and the first power electronic device is not actuated to successively turn off; the output voltage of the first dc voltage terminal set is controlled to be half of the input dc voltage at the second dc voltage terminal set.

4. The bi-directional dc/dc power converter as defined in Claim 1, wherein the controller of the bi-directional dc/dc power converter includes a first voltage detector, a second voltage detector, a first subtractor, a second subtractor, a first controller, a second controller, a first switch, a second switch, a pulse width modulation circuit, a first driver circuit and a second driver circuit.

5. The bi-directional dc/dc power converter as defined in Claim 4, wherein the first voltage detector and the second voltage detector are used to correspondingly detect voltages of the first dc voltage terminal set and the

capacitor.

6. The bi-directional dc/dc power converter as defined in Claim 4, wherein the controller further includes a high-frequency triangular wave generator used to generate a high-frequency triangular wave signal, and send it to the pulse width modulation circuit to act as a carrier signal.

7. The bi-directional dc/dc power converter as defined in Claim 1, wherein the bi-directional dc/dc power converter is applied to a single-phase half-bridge inverter; the positive terminal, the negative terminal and the neutral terminal of the second dc voltage terminal set are connected to a dc end of the single-phase half-bridge inverter; the power flow of the bi-directional dc/dc power converter and the single-phase half-bridge inverter is controlled to be bi-directional; an ac voltage source is connected to the ac end of single-phase half-bridge inverter, the ac power is converted into dc power to the second voltage terminal set of the bi-directional dc/dc power converter by single-phase half-bridge inverter, and, consequently, performs step-down conversion by the bi-directional dc/dc power converter to a half voltage at the first dc voltage terminal set of the bi-directional dc/dc power converter and provides the power into an apparatus connected to the first dc voltage terminal set; on the contrary, a dc voltage source is connected to the second dc voltage terminal set of the bi-directional dc/dc power converter,

and the bi-directional dc/dc power converter performs step-up power conversion, the first dc voltage terminal set of the bi-directional dc/dc power converter supplies two dc voltages with the same amplitude to the two capacitors of the single-phase half-bridge inverter for converting into a single-phase ac power to provide to the load.

8. The bi-directional dc/dc power converter as defined in Claim 1, wherein the bi-directional dc/dc power converter is applied to a three-wave four-wire inverter; the power flow of the bi-directional dc/dc power converter and the three-wave four-wire inverter is controlled to be bi-directional; an ac voltage source is connected to the ac end of the three-wave four-wire inverter, the ac power is converted into dc power to the second voltage terminal set of the bi-directional dc/dc power converter by the single-phase half-bridge inverter, and, consequently, the bi-directional dc/dc power converter performs step-down power conversion to supply a half output voltage at the first dc voltage terminal set and provides the power into an apparatus connected to the first dc voltage terminal set; on the contrary, a dc voltage source is connected to the second dc voltage terminal set of the bi-directional dc/dc power converter, and the bi-directional dc/dc power converter performs step-up power conversion, the first dc voltage terminal set of the bi-directional dc/dc power converter supplies two dc

voltages with the same amplitude to the two capacitors of the three-wave four-wire inverter for converting into a three-wave four-wire ac power to provide to the load.